

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**



Standard Specification for Wire-Cloth Sieves for Testing Purposes¹

This standard is issued under the fixed designation E 11; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This specification has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This specification covers the design and construction of sieves wherein a screening medium of woven wire cloth is mounted in a frame for use for precision testing in the classification of materials according to designated nominal particle size (Notes 1, 2 and 3). Methods of checking and calibrating sieves are included as information in the appendix.

NOTE 1—Complete instructions and procedures on the use of test sieves are contained in STP 447B.² This manual also contains a list of all published ASTM standards on sieve analysis procedures for specific materials or industries.

NOTE 2—Attention is called to Method C 430, which contains requirements for 2-in. (50 mm) diameter sieves used in the mineral industry, especially the cement group.

NOTE 3—For other types of sieves see Specification E 323, and Specification E 161.

2. Referenced Documents

2.1 ASTM Standards:

C 430 Test Method for Fineness of Hydraulic Cement by the 45- μ m (No. 325) Sieve³

E 161 Specification for Precision Electroformed Sieves (Square Opening Series)⁴

E 323 Specification for Perforated-Plate Sieves for Testing Purposes⁵

2.2 Federal Standard:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)⁶

2.3 Military Standard:

MIL-STD-129 Marking for Shipment and Storage⁶

2.4 ISO Standards:

ISO 565 Test Sieves—Woven Metal Wire Cloth, Perforated Plate and Electroformed Sheet—Nominal Sizes of Openings,⁷

ISO 3310/1—Test Sieves—Technical Requirements and Testing—Part 1: Test Sieves of Metal Wire Cloth⁷

¹ This specification is under the jurisdiction of ASTM Committee E-29 on Particle Size Measurement and is the direct responsibility of Subcommittee E29.01 on Sieves, Sieving Methods, and Screening Media.

Current edition approved May 29, 1987. Published July 1987. Originally published as E 11 - 25 T. Last previous edition E 11 - 81 ϵ .

² STP 447, *Manual on Testing Sieving Methods*, Available from ASTM 1916 Race St., Phila., PA 19103.

³ *Annual Book of ASTM Standards*, Vol 04.01.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

⁵ *Annual Book of ASTM Standards*, Vols 05.05 and 14.02.

⁶ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

⁷ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

3. Wire Cloth Sieve Requirements

3.1 The openings of the wire cloth of successive standard sieves progress from a base of 1 mm in the ratio of approximately $\sqrt{2}$:1. In selecting sieves from this series it is customary to take each sieve in a given range, every second sieve, or every fourth sieve.

3.2 Wire cloth for standard sieves shall be woven from stainless steel, brass, bronze, or other suitable wire with a plain weave, except that cloth with openings of 63 μ m (No. 230) and finer may be woven with a twill weave. The wire shall not be coated or plated.

3.3 Wire cloth shall conform to the dimensional requirements of Table 1 (Note 4). The average opening (distance between parallel wires measured at the center of the opening), both in the warp and shoot directions, measured separately, shall conform to the value in Column 1, within the permissible variation in average opening size given in Column 4. The maximum individual opening shall not exceed the value given in Column 6. Not more than 5 % of the openings shall fall within the range between the values given in Column 5 and Column 6.

3.3.1 The average diameter of the warp and shoot wires, taken separately, shall be within the permissible range as specified by Column 7 and Footnote A.

3.4 Both the warp and shoot wires shall be crimped in such a manner that they will be rigid when in use.

3.5 All measurements of openings and wire diameters shall be made on the wire cloth mounted in the completed sieve. Opening measurements shall be made along the mid points of the opening.

3.6 There shall be no punctures or obvious defects in the cloth.

NOTE 4—The dimensional tolerances given in Columns 4, 5, and 6 can be described with Fig. 1 and equations given in Section 4. These equations apply separately in both warp and weft (shoot) directions, with all measurements being made on the midpoints of the opening (Fig. 1).

4. Dimensions, Mass, and Permissible Variations

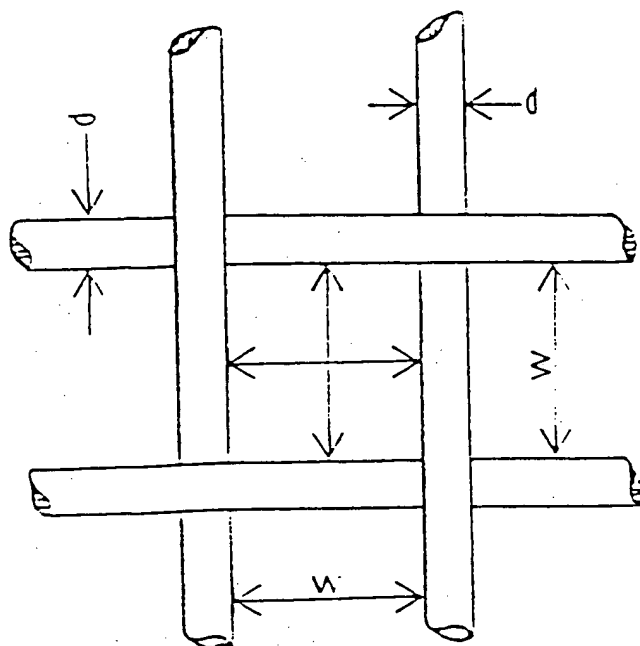
4.1 *Column 4*—In Column 4 values, the permissible variations of the average opening from the standard sieve designation shall be stated as the Y value. The average opening size shall not exceed $\pm Y$.

where:

$$Y = w^{.98}/27 + 1.6$$

4.2 *Column 6*—In Column 6 values, the maximum individual opening shall be stated as $w + X$, where:

$$X = 2(w^{.75})/3 + 4(w^{.25})$$



NOTE— w = width of opening, and
 d = diameter of wire.

FIG. 1 Proper Dimensioning for Wire-Cloth Mesh

NOTE—The formulas for both X and Y apply only where X , Y and w are expressed in micrometres

4.3 *Column 5*—In *Column 5* values, the intermediate tolerance shall be stated as $w + Z$, where:

$$Z = (X + Y)$$

Not more than 5 % of the openings shall have sizes between $w + Z$ and $w + X$. When a sieve has less than 50 openings, not more than 3 openings shall fall within the limits of $w + Z$ and $w + X$.

5. Frames

5.1 *General Requirements*—Frames for wire cloth sieves shall be made from noncorrosive material such as brass or stainless steel and constructed in such a manner as to be permanently rigid. Pans and covers shall be made so as to nest with the sieves. The wire cloth shall be mounted on the frame without distortion, looseness, or waviness. To prevent the material being sieved from catching in the joint between

the wire cloth and the frame, the joint on Sieves No. 25 through No. 635 shall be filled smoothly with solder or made so that the material will not be trapped.

5.2 *Standard Frames*—The standard sieve frame shall be circular, 8.0 in. (203.2 mm) in diameter, of seamless construction. The permissible variation on the mean inside diameter at 0.2 in. (5.08 mm) below the top of the frame shall be +0.03 in. (0.762 mm). The bottom of the frame or "sieve skirt" shall be constructed so as to provide for an easy sliding fit in any sieve conforming to the above permissible variation, and in no case shall this outside diameter be less than 7.970 in. (202.438 mm) nor more than 8.000 in. (203.20 mm). The height of the sieve from the top of the frame to the wirecloth surface shall be either 2 in. (50.8 mm), designated as full-height, or 1 in. (25.4 mm), designated as half-height. The joint or fillet shall be constructed to provide a minimum clear sieving surface 7.5 in. (190.5 mm) in diameter.

5.3 *Nonstandard Frames*—Frames of sieves having nominal openings of less than 1 in. (25 mm) but greater than 0.157 in. (4.00 mm) may be either of the standard size or of larger dimensions as may be specified in individual cases. Frames of sieves having nominal openings of 1 in. (25 mm) or more may be larger than the standard size. The use of special size and shape frames for special purposes is not precluded. For some purposes, sieve frames larger than the standard size may be either square, rectangular, or circular, and for nominal openings of 1 in. (25 mm) and coarser may be made of metal or hardwood. The use of special size and shape frames, however, shall be discouraged where the standard frames may be used, because the results are not necessarily comparable.

5.4 *3-in. (76.2 mm) Sieves*—The tolerances on the diameter of the sieve frames shall be the same as for the standard size covered in 5.2. The depth of the sieve from the top of the frame to the cloth shall be normally 1.25 in. (31.75 mm), but not less than 0.75 in. (19.05 mm).

6. Product Marking

6.1 Each sieve shall bear a label marked with the following information:

- 6.1.1 U.S.A. standard sieves,
- 6.1.2 This ASTM designation,
- 6.1.3 Standard sieve designation (from Table 1, Column 1),
- 6.1.4 Name of manufacturer or distributor and
- 6.1.5 Alternative sieve designation (from Table 1, Column 2) (optional).

TABLE 1 Nominal Dimensions, Permissible Variations for Wire Cloth of Standard Test Sieves (U.S.A.) Standard Series

Sieve Designation, (W)		Nominal Sieve Opening, in. ^c	Permissible Variation of Average Opening from the Standard Sieve Designation (y)	Intermediate Tolerance (z) ^d	Maximum Individual Opening (x)	Nominal Wire Diameter, mm ^a
Standard ^b	Alternative					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
125 mm	5 in.	5				
106 mm	4.24 in.	4.24	±3.7 mm	130.0 mm	130.9 mm	8.00
100 mm ^d	4 in. ^d	4	±3.2 mm	110.2 mm	111.1 mm	6.40
90 mm	3½ in.	3.5	±3.0 mm	104.0 mm	104.8 mm	6.30
75 mm	3 in.	3	±2.7 mm	93.6 mm	94.4 mm	6.08
63 mm	2½ in.	2.5	±2.2 mm	78.1 mm	78.7 mm	5.80
53 mm	2.12 in.	2.12	±1.9 mm	65.6 mm	66.2 mm	5.50
50 mm ^d	2 in. ^d	2	±1.6 mm	55.2 mm	55.7 mm	5.15
45 mm	1¾ in.	1.75	±1.5 mm	52.1 mm	52.6 mm	5.05
37.5 mm	1½ in.	1.5	±1.4 mm	46.9 mm	47.4 mm	4.85
31.5 mm	1¼ in.	1.25	±1.1 mm	39.1 mm	39.5 mm	4.59
26.5 mm	1.06 in.	1.06	±1.0 mm	32.9 mm	33.2 mm	4.23
25.0 mm ^d	1 in. ^d	1	±0.8 mm	27.7 mm	28.0 mm	3.90
22.4 mm	¾ in.	0.875	±0.8 mm	26.1 mm	26.4 mm	3.80
19.0 mm	¾ in.	0.750	±0.7 mm	23.4 mm	23.7 mm	3.50
16.0 mm	⅝ in.	0.625	±0.6 mm	19.9 mm	20.1 mm	3.30
13.2 mm	0.530 in.	0.530	±0.5 mm	16.7 mm	17.0 mm	3.00
12.5 mm ^d	½ in. ^d	0.500	±0.41 mm	13.83 mm	14.05 mm	2.75
11.2 mm	⅞ in.	0.438	±0.39 mm	13.10 mm	13.31 mm	2.67
9.5 mm	⅞ in.	0.375	±0.35 mm	11.75 mm	11.94 mm	2.45
8.0 mm	⅞ in.	0.312	±0.30 mm	9.97 mm	10.16 mm	2.27
6.7 mm	0.265 in.	0.265	±0.25 mm	8.41 mm	8.58 mm	2.07
6.3 mm ^d	¼ in. ^d	0.250	±0.21 mm	7.05 mm	7.20 mm	1.87
5.6 mm	No. 3½ ^e	0.223	±0.20 mm	6.64 mm	6.78 mm	1.82
4.75 mm	No. 4	0.187	±0.18 mm	5.90 mm	6.04 mm	1.68
4.00 mm	No. 5	0.157	±0.15 mm	5.02 mm	5.14 mm	1.54
3.35 mm	No. 6	0.132	±0.13 mm	4.23 mm	4.35 mm	1.37
2.80 mm	No. 7	0.11	±0.11 mm	3.55 mm	3.66 mm	1.23
2.36 mm	No. 8	0.0937	±0.095 mm	2.975 mm	3.070 mm	1.10
2.00 mm ^d	No. 10	0.0787	±0.080 mm	2.515 mm	2.600 mm	1.00
1.70 mm	No. 12	0.0661	±0.070 mm	2.135 mm	2.215 mm	0.900
1.40 mm	No. 14	0.0555	±0.060 mm	1.820 mm	1.890 mm	0.810
1.18 mm	No. 16	0.0469	±0.050 mm	1.505 mm	1.565 mm	0.725
1.00 mm	No. 18	0.0394	±0.045 mm	1.270 mm	1.330 mm	0.650
850 µm ^f	No. 20	0.0331	±0.040 mm	1.080 mm	1.135 mm	0.580
710 µm	No. 25	0.0278	±35 µm	925 µm	970 µm	0.510
600 µm	No. 30	0.0234	±30 µm	775 µm	815 µm	0.450
500 µm	No. 35	0.0197	±25 µm	660 µm	685 µm	0.390
425 µm	No. 40	0.0165	±20 µm	550 µm	585 µm	0.340
355 µm	No. 45	0.0139	±19 µm	471 µm	502 µm	0.290
300 µm	No. 50	0.0117	±16 µm	396 µm	425 µm	0.247
250 µm	No. 60	0.0098	±14 µm	337 µm	363 µm	0.215
212 µm	No. 70	0.0083	±12 µm	283 µm	306 µm	0.180
180 µm	No. 80	0.0070	±10 µm	242 µm	263 µm	0.152
150 µm	No. 100	0.0059	±9 µm	207 µm	227 µm	0.131
125 µm	No. 120	0.0049	±8 µm	174 µm	192 µm	0.110
106 µm	No. 140	0.0041	±7 µm	147 µm	163 µm	0.091
90 µm	No. 170	0.0035	±6 µm	126 µm	141 µm	0.076
75 µm	No. 200	0.0029	±5 µm	108 µm	122 µm	0.064
63 µm	No. 230	0.0025	±5 µm	91 µm	103 µm	0.053
53 µm	No. 270	0.0021	±4 µm	77 µm	89 µm	0.044
45 µm	No. 325	0.0017	±4 µm	66 µm	76 µm	0.037
38 µm	No. 400	0.0015	±3 µm	57 µm	66 µm	0.030
32 µm	No. 450	0.0012	±3 µm	48 µm	57 µm	0.025
25 µm ^d	No. 500	0.0010	±3 µm	42 µm	50 µm	0.028
20 µm ^d	No. 635	0.0008	±3 µm	34 µm	41 µm	0.025
				29 µm	35 µm	0.020

^a The average diameter of the warp and of the shoot wires, taken separately, of the cloth of any sieve shall not deviate from the nominal values by more than the following:

Sieves coarser than 600 µm	5 %
Sieves 600 to 125 µm	7½ %
Sieves finer than 125 µm	10 %

^b These standard designations correspond to the values for test sieve apertures recommended by the International Standards Organization, Geneva, Switzerland.

^c Only approximately equivalent to the metric values in Column 1.

^d These sieves are not in the standard series but they have been included because they are in common usage.

^e These numbers (3½ to 635) are the approximate number of openings per linear in. but it is preferred that the sieve be identified by the standard designation in millimetres or micrometres.

^f 1000 µm — 1 mm.

^g Not more than 5 % of the openings may fall between the limits set by the values in Column 5 and Column 6.

APPENDIX

(Nonmandatory Information)

X1. METHODS OF CHECKING WIRE CLOTH SIEVES TO DETERMINE WHETHER THEY CONFORM TO SPECIFICATION

X1.1 Every opening in the metal wire cloth in a test sieve shall be eligible for inspection for compliance with the requirements listed in Table 1.

X1.1.1 When a sieve has 20 openings or less, all openings shall be measured. In other cases the examination shall proceed in stages from a survey of general condition, to a methodical scrutiny of individual openings, and finally to measurement of opening size for compliance with the tolerances.

X1.1.2 Opening size, as described in Tests 2, 3, and 4 shall be measured accurately on equipment with a precision of at least $2.5\ \mu\text{m}$ or $1/10$ of the intermediate tolerance for the nominal opening concerned, whichever is greater.

X1.2 *Test 1 Examination of General Condition of the Wire Cloth*—For this purpose the sieve cloth shall be viewed against a uniformly illuminated background. If obvious deviations from Table 1, for example weaving defects, creases, wrinkles, foreign matter in the cloth, are found, the sieve is unacceptable.

X1.3 *Test 2 Examination of Openings For Tolerance X*—The observer shall carefully and methodically examine the appearance of all the openings, in order to detect oversize openings. Openings whose width deviates by about 10 % of the average value are apparent to the unaided eye of a skilled observer. By this method, known as the "handicap method",

it is probable that all oversize openings exceeding the average value by about 10 % or more will be detected. At the same time it is easily possible to detect sequences of large openings, and local irregularities in the weaving, appearing as distortions of the openings. If one opening is found to be oversize by more than the maximum permissible deviation X , the sieve is unacceptable.

X1.4 *Test 3 Assessment of Openings Exceeding the Intermediate Limit of $w + Z$* —Those openings whose width is between the limits of " $w + Z$ " and " $w + X$ " (See Note 4) shall be counted or their proportion of the total number of openings determined from representative sample regions. If these openings exceed the permissible limits, the sieve is unacceptable.

X1.5 *Test 4 Measurement of Average Size of Opening and Average Diameter of Wire*—After a sieve has been found acceptable by the above tests, measurements of the average size of opening and diameter of wire shall be made on sample regions. These average values shall lie within the prescribed limits given in Table 1.

X1.5.1 The average sizes shall be measured over at least 10 openings, if available, in each direction in each of at least two positions on the cloth. If the results from the two fields fall in different tolerance bands and if they contradict the information from Table 1, the average sizes at more positions on the cloth shall be checked.

SUPPLEMENTARY REQUIREMENTS

The following sections shall be applicable when United States government contractual matters are involved.

S1. Responsibility for Inspection

S1.1 Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. Except as otherwise specified in the contract or order, the producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material

conforms to prescribed requirements.

S2. Government Procurement

S2.1 Unless otherwise specified in the contract, the material shall be packaged in accordance with the supplier's standard practice which will be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules. Marking for shipment of such material shall be in accordance with Fed. Std. No. 123 for civil agencies, and MIL STD 129 for military agencies.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.